Bonneville Power Administration
Fish and Wildlife Program FY98 Watershed Proposal Form

Section 1. General administrative information

Title # Document Native Trout Populations

Bonneville project number, if an ongoing project 8032

Business name of agency, institution or organization requesting funding
Washington Trout

Business acronym (if appropriate) WT

Proposal contact person or principal investigator:

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Subcontractors.

Organization	Mailing Address	City, ST Zip	Contact Name

NPPC Program Measure Number(s) which this project addresses.
10.1, 10.2A1, 10.2B.1-5, 10.2C, 10.5A, 10.8, 10.8A, 10.8B.19.

NMFS Biological Opinion Number(s) which this project addresses.

Other planning document references.

Subbasin.
Wind, BigWhite Salmon, Little White Salmon, Klickitat, Rock Creek, Yakima, Wenatchee, Entiat, Methow, Okanogan, Walla Walla, Touchet, Tucannon, Grande Ronde, Spokane, Crab Creek, Kettle, Sanpoil, Pend O'reille.

Short description.
Photo-Document native trout populations in Columbia Basin in WA state and collect tissue samples for DNA analysis.

Section 2. Key words

Mark	Programmatic Categories	Mark	Activities	Mark	Project Types
	Anadromous fish		Construction	+	Watershed
X	Resident fish		O & M	X	Biodiversity/genetics
	Wildlife		Production	+	Population dynamics
	Oceans/estuaries	X	Research		Ecosystems
	Climate	+	Monitoring/eval.		Flow/survival
	Other	+	Resource mgmt		Fish disease
			Planning/admin.		Supplementation
			Enforcement		Wildlife habitat enhancement/restoration
			Acquisitions		

Other keywords.
DNA, stock identification, distribution, life history.

Section 3. Relationships to other Bonneville projects

Project #	Project title/description	Nature of relationship

Section 4. Objectives, tasks and schedules

Objectives and tasks

Obj 1,2,3	Objective	Task a,b,c	Task
1	Catalogue and photo-document native trout	a	Collect specimens by non-lethal means:angling, electroshocking
2	Collect tissue sample for later DNA analysis.	b	Measure specimen length to nearest mm.
		c	Take taxonomy-quality photographs of collected live specimens on-site.

		d	Take adipose or caudal fin tissue sample for later DNA analysis.
		e	Release/return live specimens to capture site.
		f	Photograph stream and associated landscape at collection site.
		g	Record, label, take field notes, identify location on map.
3	Submit collected and preserved tissue samples to laboratory for karyotype, chromosome, and microsatellite DNA analyses.	h	Submit samples to laboratory
4	Publicize results.	i	Write up results for publication in peer reviewed journal

Objective schedules and costs

Objective #	Start Date mm/yyyy	End Date mm/yyyy	Cost %
1	6/1998	10/1998	42.00%
2	6/1998	10/1998	42.00%
3	10/1998	3/1999	13.00%
4	11/1998	5/1998	1.00%
			TOTAL 0.00%

Schedule constraints.
Weather may alter start and/or finish date of field work. This contingency is factored into the timeline: a 92 day field season is given a 150 day window.

Completion date.
2002

Section 5. Budget

FY99 budget by line item

Item	Note	FY98
Personnel	Dr. Pat Trotter and 1 field assistant, 92 day field season. Total~1000 hrs. @$14.00/hr. *	$16,000
Fringe benefits	25% of Salary	$4000
Supplies, materials, non-expendable property	Film&processing, vials, anesthetic, preservatives, logbooks	$1,600

Operations & maintenance		$0
Capital acquisitions or improvements (e.g. land, buildings, major equip.)		$0
PIT tags	# of tags: 0	$0
Travel	Mileage, food, lodging, pack-trips	$14,670
Indirect costs	Administrative, overhead.	$6,820
Subcontracts	DNA lab. work	$5,000
Other	Publication cost, licenses, permits, and misc. *. Personnel costs also include $2000 for Report Wri	$4,200
TOTAL		$47,115

Outyear costs

Outyear costs	**FY99**	**FY00**	**FY01**	**FY02**
Total budget	$53000	$54000	$55,000	
O&M as % of total				

Section 6. Abstract

The 1994 Fish and Wildlife Program is to recover and preserve the health of native resident fish. Among the native resident species of concern noted in the Resident Fish section are bull trout, redband trout, and westslope cutthroat trout. All are or are likely candidates for actions under the ESA.

Before at-risk populations can be protected, their presence and status must be documented. Where introgression from introduced species is a concern, as in the case of both westslope cutthroat and redband rainbow, genetic issues must be addressed as well. Most of the remaining pure populations of these species are in relatively remote, headwater drainages which present surmountable, but not slight, logistical obstacles to properly documenting/assessing such populations.

Washington Trout proposes to conduct field visits, to remote habitats throughout the Washington State sub-basins of the Columbia still occupied by these native trout populations, for the purpose of cataloguing and photo-documenting the remaining native trout ecotypes. Taxonomy-quality photographs of living specimens will be made with the aid of a portable field aquarium. In addition, non-lethal methods will be used to take and preserve adipose or caudal fin tissue samples in a manner suitable for subsequent genetic analysis using modern DNA techniques.

Dr. Pat Trotter will lead this fieldwork. He has extensive experience in, and credentials for, doing the work proposed. Fieldwork will be begun in 1998 and extend over the course of 5 field seasons. Results will be written up by Dr. Trotter for peer reviewed publication.

Section 7. Project description

a. Technical and/or scientific background.

The present state of knowledge regarding both the original post-glacial distribution and the present distribution/status of native populations of westslope cutthroat trout (*Onchorynchus clarki lewisi)*, redband rainbow trout (*Onchorynchus mykis gairdneri*), and bull trout (*Salvelinus confluentis)* is disturbingly limited, if slowly growing. Both the original and current distributions of westslope cutthroat in the Columbia Basin between the John Day River and the Okanogan River appear surprisingly patchy. Behnke (1992) is only sure of apparent pure populations in the upper Methow Basin and in the North Fork of the John Day River, either presently or originally. This condition stems as much, if not more, from lack of evidence and lack of looking as from loss of an original more widespread number of populations.

Behnke (1992) further notes, however, extensive reduction in the known original range of westslopes in Montana and Idaho due to introgression from introduced non-native rainbow and Yellowstone cutthroat trout (*Onchorynchus clarki bouvieri)* and to displacement from these introductions and from introductions of non-native brook trout (*Salvelinus fontinalis)*. Combined with habitat loss, alteration, and destruction, pure strains of westslope are almost exclusively, if not now entirely, remnant populations confined to cold, low-order headwater streams. Such populations have retreated to their last fortress where they are especially vulnerable to genetic, demographic, and environmental stochasticities, including human-caused landscape impacts.

Habitat alteration and hybridization with non-native strains of rainbow trout, and with introduced populations of Yellowstone Cutthroat trout, have similarly resulted in the significant loss of pure redband populations, including the mid- and upper-Columbia Basin in Washington State (See Behnke 1992, Chapter 10; and Leary 1997).

Bull trout have suffered extensively from the same impacts. Fluvial and adfluvial populations have particularly labored under the impacts of loss of connectivity in their migratory pathways due to river regulation and the disruption of large river and lacustrine food chains by introduction of non-native char. Headwater resident populations constitute a major remaining outpost for the species throughout much of its range, including the Columbia Basin in Washington State. Many of these headwater populations are threatened by hybridization with introduced non-native brook trout. (See, for example, Mullan et al, 1992, Chapter 5, p. 115 and Appendix K)

If remaining populations of these three species are to be preserved and managed consistently with the concerns and provisions of Sections 7 and 10 of the 1994 Fish and Wildlife Program, their current distribution must be established. We must know where they are, if we are to properly manage them. Since the highest probability of finding existing pure populations of these species, and of documenting remaining among-population genetic and phenotypic differences, lies in relatively remote, difficult to access catchments of low-order streams, we believe that it is imperative to undertake field research into such catchments for the purpose of documenting these likely remaining pure populations.

The principal field research will involve photo-documenting representative specimens of individual populations of the species in situ, and taking non-lethal fin tissue samples from up to 20 individuals from each population for subsequent microsatellite DNA analysis of proteins. Taxonomy-quality photographs of individual fish will be taken using a portable field aquarium designed by the Principal Investigator for just this purpose.

A concomitant of such research will be the documentation of introgressed, hybridized populations. Among other motivations, such knowledge will be extremely valuable, and likely indispensable, to managers who are and will be confronted with ESA petitions and/or listings concerning these species in the Columbia Basin in the immediate future.

The Principal Investigator for the Proposed Project, Dr. Patrick C. Trotter, has considerable experience and expertise in both the biology/life history of the three species of focus, and in field work of exactly the kind proposed, including the taking and proper preservation of tissue samples for later DNA analysis. Dr. Trotter's monograph, Cutthroat: Native Trout of the West , was the result in large part of this kind of field research. Other relevant publications of Dr. Trotter's are listed in subsection g below.

b. Proposal objectives.

1. To systematically document the existence and present distribution of indigenous populations of bull trout (*S. confluentis*), redband trout (*O. mykis gairdneri*), and westslope cutthroat trout (*O. clarki lewisi*) in subbasins of the Columbia Basin in Washington State. Selected subbasins include: Wind River, Little and Big White Salmon rivers, Klickitat River, Walla Walla river, Yakima River, Wenatchee River, Entiat river, Methow river, Okanogan River, Tucannon river, and Grande Ronde River.

2. To document and assess the extent of hybridization between indigenous redband rainbow and introduced, non-indigenous salmonids, particularly Yellowstone cutthroat trout (*O. clarki bouvieri*) and coastal rainbow trout (*O. mykis irideus*).

3. To document and assess the extent of hybridization between indigenous westslope cutthroat and introduced, non-indigenous salmonids, particularly Yellowstone cutthroat, redband rainbow, and coastal rainbow.

4. To document and assess the extent of hybridization between indigenous bull trout and introduced, non-indigenous brook trout.

These objectives will be achieved by photographing individual specimens belonging to pure and/or hybridized populations of the three primary species on-site in their native habitats, taking length measurements of each fish, and taking adipose or caudal fin tissue samples for subsequent micro-satellite DNA analysis.

Results will be written up in several formats. Some of the results and photographs will be used by the Principal Researcher, Dr. Pat Trotter, to revise and update his 1987 monograph Cutthroat: Native Trout of the West. Some results pertaining to each of the principal species will be written up by Dr. Trotter, in some cases in collaboration with a principal researcher from the laboratory which will be subsequently contracted to do the DNA analysis (see subsection “e” below), in fisheries journals such as the Transactions of the American Fisheries Society. Annual Progress Reports will also be written and submitted to CBFWA and BPA. The precise location of each fish photographed and each fish from which a tissue sample was taken will be located on USGS 7.5-minute maps with the use of compass and GPS for later incorporation into CBFWA databases.

c. Rationale and significance to Regional Programs.

The need to document the present distribution of remaining pure indigenous populations of westslope cutthroat, redband trout, and bull trout has been discussed above, as has the related need to document the extent and degree of hybridization within these species and the extent and degree of displacement by non-indigenous salmonids. All are pre-requisites to assessing present and potential future threats to the continued existence of these native resident salmonids in the Columbia Basin. Assessment of such threats, based in part upon the information expected to result from the Proposed Project, is essential to the choice, design, and implementation of protection and recovery strategies which may, and very likely will, be necessary in order to implement and maintain consistency with the sections and sub-sections of the 1994 Fish and Wildlife Program noted and/or commented upon below.

The introduction to Section 10 (Resident Fish) of the Program (p.10-1) explicitly notes the three trout species which are the focus of the Proposed Project as “resident fish species of special interest…”. Sub-section 10.1A. calls for “the identification of resident fish mitigation objectives and, to the extent appropriate, associated rebuilding schedules, survival targets and performance standards.” 10.2A requires relevant parties to “accord highest priority to weak, but recoverable, native populations injured by the hydropower system…” and to “accord high priority to areas of the basin where anadromous fish are not present.”

With regard to these provisions, we note several relevant considerations. First, we must locate all remaining native resident populations before we can protect and/or rebuild them in a systematic manner that is both biologically and financially efficient.

Second, impacts from the hydropower system upon these populations, and others which have previously been lost due to the development of the hydropower system encompass more than simply the loss of fluvial habitats due to flooding caused by reservoir construction on the Columbia and Snake mainstems. They include flooding and habitat discontinuity impacts from construction of irrigation diversions on innumerable tributaries which development of the hydropower system on the mainstem significantly helped to make possible. And they include impacts on resident salmonid populations that are the direct and indirect result of declines and losses of anadromous salmonid populations, some of which we are only recently becoming aware of and understanding. Nutrient loading from salmon carcasses is perhaps the most obvious and important example.

Third, mitigation can and must include special efforts to protect headwater populations of native resident salmonids whose remaining small populations represent a vastly shrunken vestige of a much more widespread series of resident meta-populations. These remaining populations retain the genetic legacy of the wider metapopulation, which was cut down due in large measure to the development of the hydropower system. As noted above, these populations are particularly subject to genetic and demographic stochasticities. Mitigating for the existence of these stochasticities, which result from the reduction and loss of meta-population structure, are genuine mitigation responsibilities under Section 10. Mitigation in these cases require preservation of the remaining population, even though particular headwater populations may have suffered no loss directly attributable to reservoir construction or irrigation development. This is consistent with the introduction to sub-section 10.8 and with 10.8A.

Numerous other sub-sections of sections 7 and 10 support the Proposed Project.

Section 7.7, which calls for cooperative and comprehensive watershed management, stresses the need to “enhance and expedite implementation of actions by clearly identifying gaps in programs and knowledge.” The Proposed Project is conceived to address significant gaps in relevant knowledge.

Sub-section 10.2B addresses natural and artificial propagation and the preservation of genetic diversity of native resident salmonids. It calls explicitly for “a thorough and comprehensive approach to conserving genetic diversity…for native species.” Sub-section 10.2B.1, 10.2B.2, and 10.2B.5 explicitly extend genetic policy measures for anadromous salmonids called stated in sub-sections 7.1, 7.2, and 7.4 to resident salmonids.

Sub-section 7.1C notes that obtaining “base-line information that will improve management and conservation of wild and naturally spawning populations is needed.” The Proposed Project is conceived to achieve precisely this for resident populations. Sub-section 7.1C.2 explicitly calls upon Bonneville to fund a study of a sort to which the proposed Project is directly relevant in the case of resident fish.

Sub-section 7.1D states that “explicit priority” must be given to “conserve, manage, and rebuild the basin’s remaining wild and naturally spawning populations…” The Proposed Project is also germane to the implementation of the development of a Pacific Northwest Biodiversity Institute called for in sub-section 7.11.

Finally, we point out that one of the unique features of the Proposed Project is obtaining taxonomy-quality photographs of live specimens of the three species of concern, in situ. Significant in its own right for detailing unique morphology and coloration of individual populations of the Basin’s remaining native resident trout species, this provides a unique complement to the genetic material which will also be obtained for each population.

d. Project history

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e. Methods.

1. Redband, westslope cutthroat, and bull trout specimens will be collected non-lethally, principally by fly angling with single barbless hooks. This method is particularly well suited to the lower order streams in which the bulk of the collecting is to be done and to the generally warm temperatures between mid-June and October during which the filed work will be conducted.

Additionally, in the few envisioned cases (e.g., bull trout >12 inches fork length or excessive turbidity) in which angling does not result in the minimum desired number of fish per population for tissue sample collection of 10, backpack electroshockers will be used.

After each fish is caught, it is placed in a 10-gallon bucket, which has been lined with a large heavy gauge dark plastic garbage and filled to within 3 inches of the lip with fresh stream water. The garbage sack provides shade, darkness, and some texture all of which helps to settle the fish by providing a sense of cover. When the fish being collected are under 10 inches (254 mm) in fork length, as is usually the case with redband, westslope, and bull trout in the lower order streams to be sampled (see, e.g., Mullan et al. 1992, p.114 and Appendix K, p.409), up to 8 individuals can be safely detained for up to 30 minutes in such a bucket.

A portable streamside aquarium measuring approximately 22x16x4 inches is set up on a portable table at streamside where the sampling is to take place. The aquarium has an inlet port attached to the lower portion of one of the narrow sides to which a tube connected to a battery-driven pump is attached. This allows for fresh stream water to be continuously circulated through the aquarium, providing both well-oxygenated cool water and a mild current into which the fish faces thereby facilitating a realistic and high taxonomic quality photograph of the fish to be taken. An outlet port on the upper portion of the opposite narrow side to which a drain tube is attached allows for a constant level just short of overflowing to be maintained as water is continuously pumped from the stream and circulated through the aquarium.

Collection is undertaken from approximately 50 yards upstream and downstream of the location of the aquarium. Depending upon fish density, this normally allows for up to 8 individuals per sampler to be collected and transported to the position of the aquarium within 30 minutes of the first sample being placed into a bucket. When necessary fresh stream water is easily replaced in the bucket if collection or photographing will exceed the 30-minute period.

Each fish is removed, one at a time, from the bucket using a large soft-meshed aquarium dip-net and placed into the aquarium. A series of taxonomy-quality photographs of the fish holding its station while facing the flow are taken. The fish is then removed from the aquarium with the dip-net and placed into a 5-gallon bucket containing fresh stream water and MS-222 to anesthetize it. (Additionally, the use of Clove Oil as an anesthetic alternative to MS-222, as reported by Anderson, McKinley, and Colavecchia 1997, will be evaluated.)

After the fish has been mildly anesthetized it is removed from the bucket and placed onto a V-shaped rule and its fork length measured and recorded to the nearest millimeter, and its section of its adipose or caudal fin approximately ¼ inch square is removed with a pair of small surgical scissors. The tissue sample is placed into a small plastic screw-capped vial containing 95% denatured ethyl alcohol, the vial capped, and the fish released into another bucket filled with fresh stream water and allowed to recover before being released into the capture reach.

The vial containing the fresh tissue sample is labeled externally with a pre-assigned alphanumeric code, which is unique to that fish. In addition, the code is written on a waterproof label which is then placed inside the vial along with the tissue sample. The code is recorded in a waterproof field logbook together with the fish's length, film role number and exposure numbers, date and stream location information. The vial is placed in a lidded rack specifically designed to contain the vials, the lid placed on the rack thus firmly securing the individual vials inside the rack, and the rack placed in an iced cooler.

2-4. The vials containing the labeled tissue samples will be delivered to a laboratory where macro-satellite DNA analysis will be performed. All samples will be analyzed blind. Samples will be segregated and vials grouped as "same species collected from one stream or stream reach". This will be the only information given to the analyst in addition to the unique alphanumeric identification written indelibly on each vial and on the label placed inside the vial at the time of collection. Tissue samples of pure strain of the species at issue which have been collected from outside Washington State subbasins will be submitted blindly and randomly to the laboratory along with the collected samples to serve as controls on the sensitivity and specificity of the analyses.

Depending upon final cost and availability, one of the following three laboratories will be subcontracted to do the DNA analyses in question: Professor Fred Allendorf, University of Montana; Professor Paul Bentzen, University of Washington; Dr. Rick Williams, Boise, Idaho. Individuals at these laboratories have variously recommended between 10 and 20 tissue samples from each population for obtaining a high likelihood of one or more readable samples for the kind of DNA analysis in question.

Based upon evidence collected by the Principal Investigator, Dr. pat Trotter, in 1992 in a subbasin of the Yakima River and results reported in 1994 for subbasins of the Methow River (Proebstel and Noble, 1994), and sampling in Montana and Idaho over the past decade (reported, e.g., in Behnke 1992, in Gresswell 1988 and by Watson and Hillman, 1997), we expect to document both small, pure populations of westslope cutthroat, redband rainbow, and bull trout principally in small headwater streams and upstream of natural barriers. We also expect to find evidence of hybridization of the types noted in subsection "b" above in all three species. We further expect to document evidence of disruption and displacement of some populations of each of these three species by non-indigenous species, particularly brook trout.

Based upon preliminary fieldwork in 1997 in the Yakima Basin, we expect to document the presence of several small headwater refuge populations of pure westslope cutthroat trout. In conjunction with results from other fieldwork to be conducted by the proposed project, we expect that this will contribute to a significant expansion and refinement to our knowledge of the original extent of post-glacial colonization of the mid-Columbia Basin by westslope cutthroat.

In combination, all of the above will significantly increase our understanding of the impacts of euroamerican colonization, including the development of the hydropower system, on the native resident trout species of the Columbia Basin in Washington State. Such an understanding is fundamental to assessing the current risks facing the remaining pure native populations of these species and to undertaking appropriate measures to insure their continued existence and recovery.

f. Facilities and equipment.

All photographic equipment, collection equipment, including backpack electroshockers, vehicles for field use, camping equipment, office space and equipment, including computers are already in-hand by Washington Trout and/or by the Field Investigators.

Type here (provide answers in paragraph form)

g. References.

Anderson, W.Gary, R.Scott McKinley, and Maria Colavecchia. 1997. The Use of Clove Oil as an Anesthetic for Rainbow Trout and Its Effect on Swimming Performance. North American Journal of fisheries management 17: 301-307.

Behnke, Robert J. 1992. Native Trout of Western North America. American Fisheries Society Monograph 6.

Gresswell, Robert E. (editor). 1988. Status and Management of Interior Stocks of Cutthroat Trout. American Fisheries society Symposium 4.

Leary, Robb F. 1997. Hybridization Between Introduced and Native Trout in Waters of the Colville National Forest. Wild Trout and Salmon Genetics Laboratory Report 97/3. Division of Biological Sciences, University of Montana, Missoula, Montana.

Mullan, James W., Kenneth Williams, Granville Rhodus, Tracy W. Hillman, and John D. McIntyre. 1992. Production and Habitat of Salmonids in Mid-Columbia River Tributary Streams. U.S. Fish and Wildlife Service, Monograph I.

Proebstel, Don S. and Sandra M. Noble. 1994. Are “Pure Native Trout in the Mid-Columbia River Basin?” In Wild Trout V.

Trotter, Patrick C. 1987. Cutthroat: Native Trout of the West. Colorado Associated University Press.

Trotter, Patrick C. and Peter A. Bisson. 1988. History of the Discovery of the Cutthroat Trout. In Gresswell 1988.

Trotter, Patrick C. 1989. Coastal cutthroat trout: A life history compendium. Transactions of the American Fisheries Society 118: 463-473.

Trotter, Patrick C., P.A. Bisson, and B. Fransen. 1993. Status and Plight of the Searun Cutthroat Trout. In Cloud, Joseph G., and Gary H. Thorgaard (Eds.) Genetic Conservation of Salmonid Fishes. Plenum Press 1993.

Trotter, P.C. 1997. Sea-Run cutthroat Trout: Life History Profile. Pages 7-16 in J.D. Hall, P.A. Bisson, and R.E. Gresswell, editors. Sea-Run Cutthroat Trout: Biology, Management, and Future Conservation. Oregon Chapter. American Fisheries Society, Corvallis.

Section 8. Relationships to other projects

Outside of recent and ongoing work by personnel of the US fish and Wildlife Service in Leavenworth, Washington in the Methow, Entiat, and Wenatchee River Basins (Mullan et. al 1992 and Proebstel and Noble 1994) we are unaware of any systematic activity of the sort proposed. We know of none at all which aim to acquire the level of photographic documentation which the Proposed project does. Efforts have been taken to determine the extent and substance of USFWS' research in the three river basins to avoid duplication of effort.

The Proposed Project is also integrally related to the implementation of Washington State's recently adopted Wild Salmonid Policy and, in particular, to the Additional Policy Guidance to WDFW regarding fish population management which is a part of the state's policy.

Section 9. Key personnel

Dr. Totter's qualifications to conduct the proposed work have been discussed in Section 7a above. Dr. Trotter is self-employed as a fisheries science consultant. He has a Ph.D. in Chemistry from Lawrence University in Appleton, Wisconsin. Five especially relevant recent publications are listed in Section 7g above.

Dr. Trotter will be assisted in the fieldwork by Mr. William (Bill) McMillan. Mr. McMillan is a gifted naturalist and field worker, and an experienced and outstanding nature photographer. Among his relevant experience is the initiation of systematic and still ongoing wild summer steelhead snorkel surveys on the Wind and Washougal rivers in the late 1970s. Recently, in 1995 and 1996 he was a camp leader for the Wild Salmon Center's Kamchatka Steelhead Project, a joint scientific venture between the Wild Salmon Center and Moscow State University (Russia).

The Project involves using angling on remote parts of the Kamchatka Peninsula in Russia during a 6 to 8 week time period in September and October for the sole purpose of collecting scale and tissue samples from native steelhead and trout for a joint research project involving Moscow State University, the University of Washington, and Colorado State University. Mr. McMillan's responsibilities as camp director included looking after the safety of 12 anglers in a remote region with limited logistic support, and directing and overseeing a systematic angling survey of 2 adjacent river drainages, including instructing and monitoring the anglers in collection of tissue samples and the taking of field notes.

In 1996/97 Mr. McMillan led a two-person field crew in a systematic survey of tributaries of the Tolt and Snoqualamie Rivers in order to assess fish presence and stream type classification, and culvert problems. This work involved a minimum of four 10-hour days per week from late October through June. This work requires excellent woodsmanship and map-reading skills. It also involves accurately transcribing field data onto Washington State Forest Practice Base Maps which must be submitted to the Department of Natural Resources to document change of stream-type.

Both Dr. Trotter and Mr. McMillan have current Washington State Scientific Collection Permits and both are experienced and skilled in the use of backpack elecroshockers. Employees of Washington Trout have been certified by Washington Department of Fish and Wildlife to conduct training courses in the use of backpack electroshockers. Mr. McMillan has been one of the instructors for this course.

Based upon past experience, Dr. Trotter estimates a normal field season for this kind of project to consist of 92 day, of which an average of 66 days can be expected to be in-the-field and the remaining 26 days in-transit, including weather-related delays. Filed days during summer months can normally be expected to exceed 8 hours. However, for the purpose of this project each of the 92 days will be assumed to consist of 8 hours. No overtime will be recorded, taken, or paid. All such overtime will be donated as a match on the part of Washington Trout toward the costs of this project.

As a further part of this match, the 92 days will be transformed into 3 months and each month billed at 166.67 hours, which is slightly more than four 40-hour weeks. This yields a total of 500 hours for each of the two field workers. Each hour will be billed at $14.00 plus benefits. Dr. Trotter's normal fee when doing consulting work for a non-profit organization such as Washington Trout is $40.00 per hour. This amounts to an annual match by Dr. Trotter of $13,000 excluding benefits.

Also please note that Alt-C failed to calculate the total for the fiscal year '98 budget in section 5. The correct total is $52,290. Also, personnel costs in section 5 consist of $14,000 for the 1000 hours of field work, plus $2000 for Report writing time by Dr. Trotter and by the Project Lead, Nick Gayeski.

Section 10. Information/technology transfer

This has been described in Section 7b above.